

## Clinical and Laboratory Notes

### IMPLICATIONS OF SURFACE TEMPERATURES IN THE DIAGNOSIS OF BREAST CANCER\*

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ONE OF THE IMPORTANT biological characteristics of malignant tumours is the increased rate of growth as compared to that of the surrounding or host tissue. The malignant propensities are directly related to the speed of cell division. This in turn is reflected by accelerated local metabolism which is adequately supported by increased blood and lymphatic vascularity. These biological alterations can be readily detected by estimating temperature changes in the tumour or its immediate environment. Heat energy is transferred by the process of convection, conduction and radiation. It is possible to record, with a fair degree of accuracy, the transfer by the latter two methods.

The recording of heat energy by conduction from the skin can be performed by the calculation of the electromotive force created at the juncture of two dissimilar metals such as platinum and rhodium. Such a device is commonly called a thermocouple. This instrument appears to be a useful diagnostic tool where breast cancer is suspected, as the technique can easily be applied to the skin over the tumour, or in the case of a deep-seated neoplasm, the ipsilateral areola.

Heretofore considerable investigative work has been done in determining the possibilities of infra-red phlebograms. Massopust<sup>1</sup> and co-workers have published a series of such observations. The technical limitations of this approach are apparent when one realizes that the most sensitive infra-red photographic emulsions extend to only 11,000 Angstrom units, and in this part of the spectrum the intensity of radiant energy is extremely small.

Another method which holds some promise is the use of the Baird Evaporograph, an instrument designed to give a direct thermal picture on a very thin oil film. The main principle employed in this apparatus is the differential evaporation of an oil film on a transparent membrane which can be observed or photographed in black and white or colour. In its present state of development, the Evaporograph has a high resolution for objects having sudden or abrupt temperature changes, however slight (such as blacked-out



Fig. 1.—Evaporograph image of patient with carcinoma of right breast.

cities at night), but where the temperature shows a smooth fall-off, the oil image lacks sensitivity. This remarkable device is quite capable of much future development (Fig. 1).

It is fascinating to speculate on the diagnostic possibilities of a heat-sensitive imaging device capable of surveying breasts in much the same manner as mass screening by chest radiography is carried out for the early detection of tuberculosis. It is a problem of investigating sensitive conductive surfaces that extend well into the infra-red spectrum. For instance, lead iodide is found to be sensitive up to 12 microns (12,000 Å). However, the body temperature spectrum extends from 40 to 160 microns.

The Morgan<sup>2</sup> principle of intensification of minimal contrast x-ray images is one of the most remarkable advances in radiology in the past decade, and it is quite possible that the principles involved therein could be applied to thermal surfaces.

In addition to the early diagnosis of breast cancer, the effects of chemical agents toxic to tumours might be observed by heat imaging. Indeed we have already found that the effects of radiation, and some drugs, are manifested in decreased tumour temperatures.

In a series of 26 patients, subsequently proven to have breast cancer, the average detectable temperature rise in either the area of the tumour or the ipsilateral areola was 2.27° F. The maximum was 3.5° and the minimum 1.3°. In an additional two cases showing a rise of between 1.5 and 2° F., the pathological diagnosis was of doubtful malignancy.

Temperature determinations have been useful in the preoperative diagnosis of benign breast

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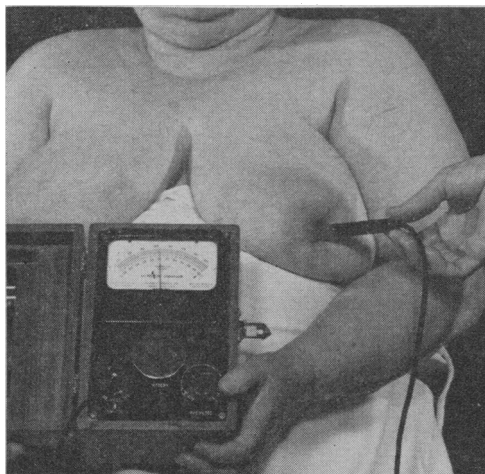


Fig. 2

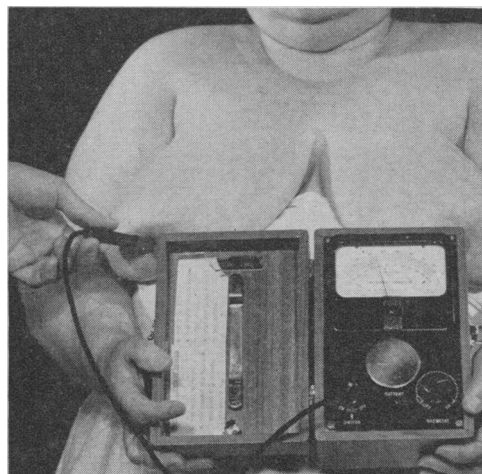


Fig. 3

Fig. 2.—Carcinoma, left breast. Fig. 3.—Right breast negative in same patient, showing temperature differential.

lesions. No temperature rises have been associated with cysts or fibroadenomata.

#### CASE REPORT

Mrs. Y.C., aged 63, was admitted to the Royal Victoria Hospital, April 30, 1956, with a diagnosis of chronic calculus cholecystitis. The patient was in no distress. She had been on a reducing diet for several months, and at the time of admission weighed 263 lb. There was no previous significant breast history, but the intern noticed a small area of thickening in the upper outer quadrant of the left breast. She was not aware of any breast abnormality heretofore and several days earlier had been subject to a routine physical examination by her family doctor who found her breast free from gross clinical disease. Examination with the thermocouple disclosed a significant elevation in temperature over the area of thickening, and also over the left areola (Figs. 2 and 3). Examination of the right breast showed no structural changes or elevation in surface temperature. After negative skeletal and pulmonary survey, radical mastectomy was carried out on May 4, without preliminary biopsy. No gross involvement of the axillary lymph nodes was noticed at the time of operation.

*Pathological report* (summary): The tumour is an intraductal carcinoma exhibiting stromal invasion. There is no evidence of lymphatic or blood vessel channel invasion.

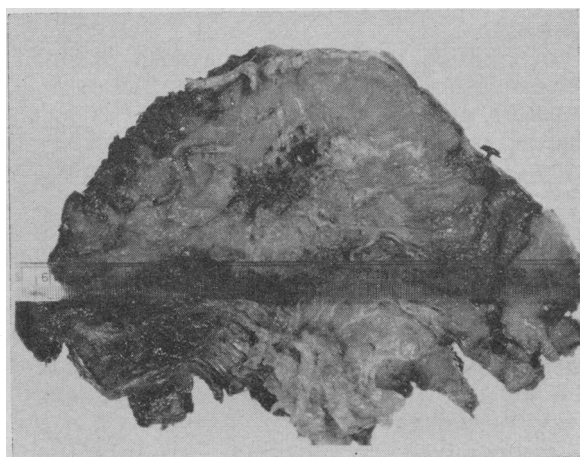


Fig. 4.—Breast depicted in Fig. 2. Tacks show relation of nipple to tumour.

#### SUMMARY

A useful diagnostic tool applicable to early breast cancer is described.

#### REFERENCES

1. MASSOPUST, L. C. AND GARDNER, W. D.: *Surg., Gynec. & Obst.*, 97: 619, 1953.
2. MORGAN, R. H.: *Am. J. Roentgenol.*, 75: 69, 1956.

### MECHANICAL DRAINAGE OF CEDEMA IN CONGESTIVE CARDIAC FAILURE\*

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IN THE TREATMENT of chronic cardiac failure one encounters cases with normal serum levels of electrolytes, in which diuresis produced by low sodium diet, digitalis, mercurial diuretics, ammonium chloride, Diamox, Mictine and various combinations of these drugs does not keep pace with the accumulation of fluid. The oedema then becomes intractable and other means must be employed for removal of the excess fluid. Recently Wild<sup>1</sup> described an ingenious method for mechanical drainage of massive oedema. We employed this method in the case here reported, with spectacular results.

#### METHOD AND MATERIAL

A block of cork (12.5 x 6.2 x 1.8 cm.) is used, and 4 rows of three (20 gauge) needles are

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